WATER IN THE MARTIAN CRUST: SLOPE-PARALLEL LAYERS IN THE WALL OF MELAS CHASMA ARE HESPERIAN-AGE SOIL HORIZONS. A. H. Treiman, Lunar and Planetary Institute, Houston TX 77058.

In the south wall of Melas Chasma, erosional scarps expose color and strength layers in the highlands crust. The layers do not form a coherent stratigraphy; each scarp exposes a different layer sequence, parallel to local pre-scarp topography. These relations suggest that the layers formed in place, by alteration of pre-existing material; i.e., the layers are soil horizons. Alteration was most likely mediated by liquid water, probably as intergranular films. The water was likely derived from ground ice.

METHOD. The southern wall of Melas Chasma (13.5S, 69.25W) was imaged by Viking Orbiter I as frames 776A61-64. Mapping has been from moderate resolution images, ~250 m/p [1, 2]. VO 776A61-64, taken through the 'clear' filter, have nominal spatial resolutions of ~ 14.5 m/p. The sun was at 58.5°W azimuth, incidence angle (wrt geoid) = 64.4°. The spacecraft was pointing ~75°W of N, emission angle (wrt geoid) ~25°. In this area, the Melas Chasma wall trends approximately E-W and its average slope is probably ~30°N. Because the wall is irregular, actual incidence and emission angles vary widely.

EROSIONAL TOPOGRAPHY. The wall of Melas Chasma transects, and so is younger than, the early Hesperian surface of Melas Dorsa [3]. In this area, the wall has smoothed 'spur and gully' morphology [4]. Between and below spurs, the 'gullies' are smooth, nearly planar or broadly curved slopes; channels or thalwegs are not observed. Spurs and gullies are cut by landslides with sharp headscarps, rotated and jumbled coherent blocks at the scarp bases, and lobate distal deposits [5]. Spurs and gullies are also cut by troughs: theater-headed, U- or V-shaped valleys that lack obvious outflow deposits. One trough has a distinct, flat bottom.

EXPOSED LAYERS. Many lithologic layers are apparent in the Melas Chasma wall; layering at the wall top was discussed by [6]. Other layer sequences are visible on erosional scarps, especially the headwall of the largest landslide (Fig. 2). Downward along this wall, visible layers include (Fig 2): (i) strong, radiance factor (rf) =0.070; (ii) strong bright, rf=0.075; (iii) very thin dark, rf=0.065; (iv) weak, rf=0.070; (v) weak dark, rf=0.055; and (vi) weak, rf=0.060. Layers (i) and (ii) vary in thickness; a ~150 m boulder of layer (ii) material is visible on the landslide scarp (Fig. 2). The same sequence is exposed along strike in the trough immediately west of the landslide scarp. Other similar sequences are exposed in the west wall of the largest landslide, and the headwalls of minor landslides at the toe of the trough (Fig. 2). These layering sequences are all parallel to the **local** ground surfaces before scarp formation. Thus, the layers are not horizontal, and the layer sequences to not share the same orientation (strike and dip).

NOT DEPOSITIONAL, BUT DIAGENETIC. Because the layer sequences are not horizontal, but parallel to local topography, it is unlikely that they are sedimentary deposits. The local surfaces slope (and sloped) at ~30°, while sedimentary deposits are nearly always flat-lying. Original sedimentary layers can be so steep, as in sand dunes and prograding deltas, but the thickness of the layer sequences (Fig. 2), and their age on Mars make these latter settings unlikely. Parallelism with local surfaces suggests that the layering post-dates the surfaces, and so suggests that the layers formed in situ by alteration of pre-existing material; i.e., the layers are diagenetic in origin, soil horizons developed parallel to slopes (vis. [7]). A similar origin was proposed for the layers at the wall tops in Valles Marineris and Ares Vallis [6, 8].

GROUND WATER AND ICE. Diagenetic alteration requires material transport, most reasonably by liquid water. The water probably came from the martian crust, which was probably not saturated with water as there are no signs of abundant liquid water like spring deposits, river courses or deposits, or horizontal water-table deposits. Water transport and diagenesis could have been driven by temperature and humidity differences between the wall surface and the adjacent subsurface; the source of water was likely ground ice [9]. To form the wall layers, water must have been present more recently than the early Hesperian, the oldest possible wall age, and possibly into Amazonian times, the ages of landslides [5]. The presence of ground ice so near Mars' equator so recently is consistent with abundant water in Mars [10], and with the availability of water to alter martian meteorites [11, 12].

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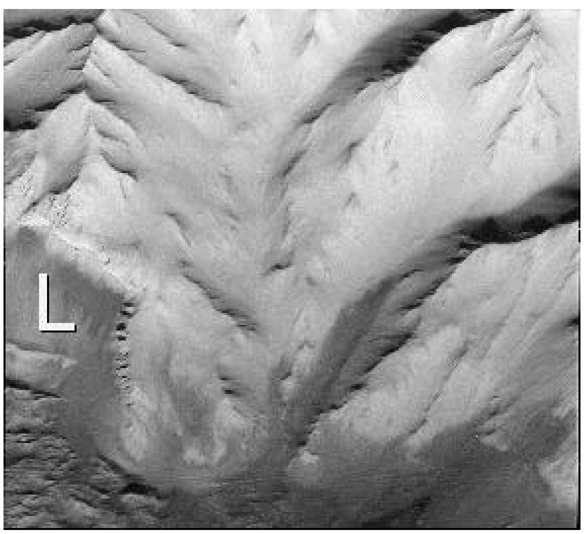

Fig. 1. F776a61, fov ~17 km across. The base of the Melas Chasma wall. Fallen blocks from largest landslide 'L' visible at bottom left (east).

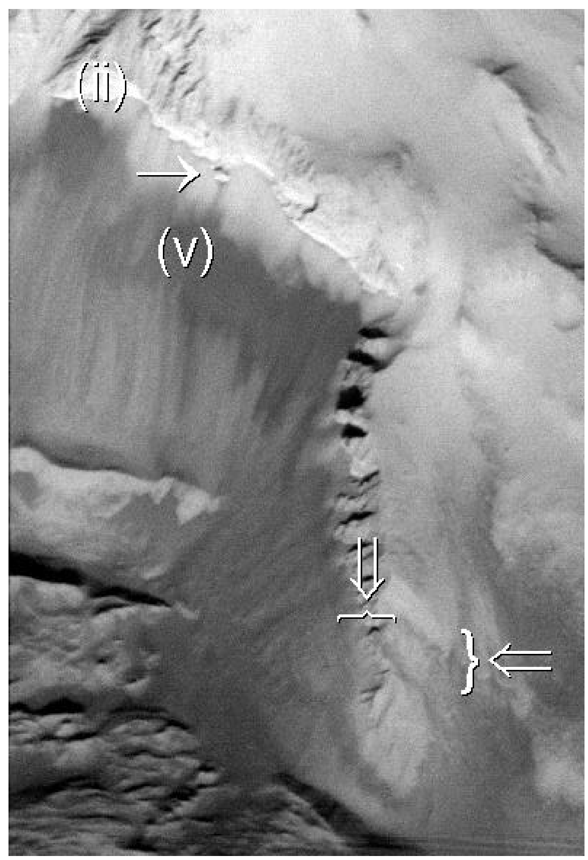

Fig. 2. (→) From Fig. 1. Layers (ii) and (v) labeled in exposed in headscarp scarp; layer (ii) also exposed to west in adjacent trough. Double arrows are layer sequences in other erosional scarps. Single arrow points to loose boulder of unit (ii) on landslide headscarp.